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Ali Reza Arsiya[1], Mehrdad Mazloomi[2]
[1]Islamic Azad University Central Tehran Branch, Iran, Tehran
[2]Islamic Azad University Qazvin Branch, Iran, Qazvin
e-mail: alireza.arsiya@yahoo.com, mehrdad.mazloomi@gmail.com

AN INVESTIGATION ON THE INFLUENCE OF RIVER ON MORPHOLOGICAL ASPECTS OF HISTORICAL CITY

Abstract: *The nature has a profound impact on urban form of historical cities. This study investigates the influence of river running through the historical part of Rasht city in Iran. As the main objective, we attempt to find the relationships between the morphological parameters of the fabric next by the river. Integrated with a quantified statistic, a sampling approach for both sides of the river is carried out. The results show that certain attributes rule the morphological aspects of sampled blocks where paths are ruling wizards between them. Orienting North- South paths, blocks are linear with small size grain. In East-West orientation, one can find a homogenous distribution of urban grain in blocks. In addition, it is revealed that geometry of parcels correlates with urban blocks and nearby path.*
Keywords: *urban morphology, river, block, path.*

Introduction

Urban morphological studies usually describe the history of a city and how it has grown to a city (Srinurak,2017: 3), and systematically reflect urban phenomena, with the aim of describing the evolution of a city over time (Marzot, 2016: 62). Therefore, the morphological studies about an area has changed into a large multi- disciplinary subject, in which, in addition to geography, economy, urban planning, statistics and sociology, many other subjects are involved (Caglioni, 2005: 33). A true insight into morphology helps urban planners to be aware of changes and developments in local patterns and processes (Behzadfar, 2012: 842). Urban morphological data includes various descriptions, for example, the data of roads, construction location, the data about elevation, materials, water, etc. (Sievinen, 2011: 2).

In urban studies, the urban morphology is a classic study of urban forms and their formation process and basis over time (Moosavi, 2017: 1). Urban morphology is an approach to the study and design of urban form systems which include physical dimensions and urban structures such as plots, blocks, streets, buildings, and open spaces which are a part of the historical evolution of cities (Sanders, 2008: 3). The basic principles of urban morphology entail an insight into development of urban landscapes in the long run and awareness about the unique cultural, socio-economic and political influences in some specific periods that let urban landscapes be recognized as an outline of the achievements and investments in successive generations (Larkham, 2006: 123).

Today, urban developments are mostly in line with modernism and with disregard to historical fabrics which consequently leads to split between the new and old fabrics. The old fabric is developed by understanding the environmental conditions (such as rivers), and this leads to a fabric which has preserved its identity and appearance based on the regional climate and culture that inspire the sense of belonging and vitality. However, the influence of modern urbanization has led to the fact that in most cities regardless of local conditions, there is a uniform architecture devoid of identity.

Therefore, we should look for a process that would help identify the urban fabric and morphologically identify its dimensions and seek to solve its physical problems. Understanding this pattern helps to make a future development model for a city based on approaches and

features which take into account the identity and climatic conditions inspired by morphology of old fabrics, and then we can explain the future model of the city (Fig. 1).

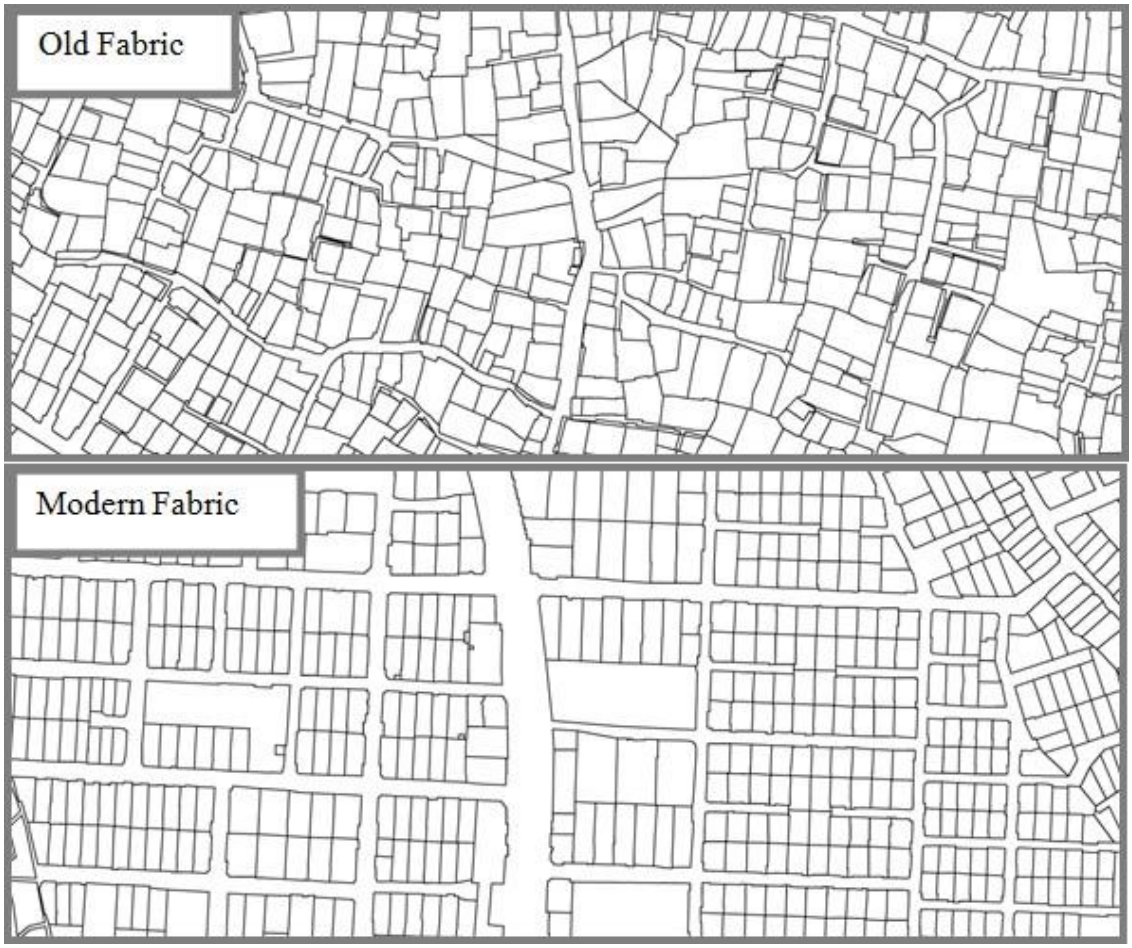

Figure 1. Fabric split: In above images, split in form is observed (Source: the author)

On the other hand, a city is nothing but blocks and paths between them. Thus, form in urban fabric can be viewed in terms of blocks and paths as the most important components of urban uses. Our knowledge of fabric in urban morphology is based on the general typology (quality) and measurement (quantity), and the total of this information can give us an overview of the morphology of the study area.

Therefore, by analyzing the two dimensions of blocks and paths based on the morphology and measurement of different dimensions, various factors in the field of morphology are obtained. Accordingly, we selected the city of Rasht as the sample which was originally a village between two rivers of Goharood and Siyahrood (Zarjoob) (Bandi 2009: 18); we have studied the area that river passes through.

Methodology

This study was conducted by reviewing the literature and collecting the data using common research methods. We have used descriptive, comparative and analytical, library methods, etc., at different stages of data collection. We have also conducted field studies using the maps developed by GIS and AutoCAD, and making use of the Google Earth, comprehensive development plan of Rasht, etc.

The structure of research is based on morphology of paths and blocks. In both paths and blocks, the study is generally based on typology (quality) and measurement (quantity). Typology plays the most important part and is based on observation and examination of the blocks, and

extracting the relevant data from it, including form of the blocks, distribution of paths, their orientation, etc. Measurement could be made in different types including length, coefficients, number of building sites, etc. After selecting the urban area, the western and eastern sides of the river were divided into 300-meter-long columns, and then we specified the blocks of each column (Fig. 2).

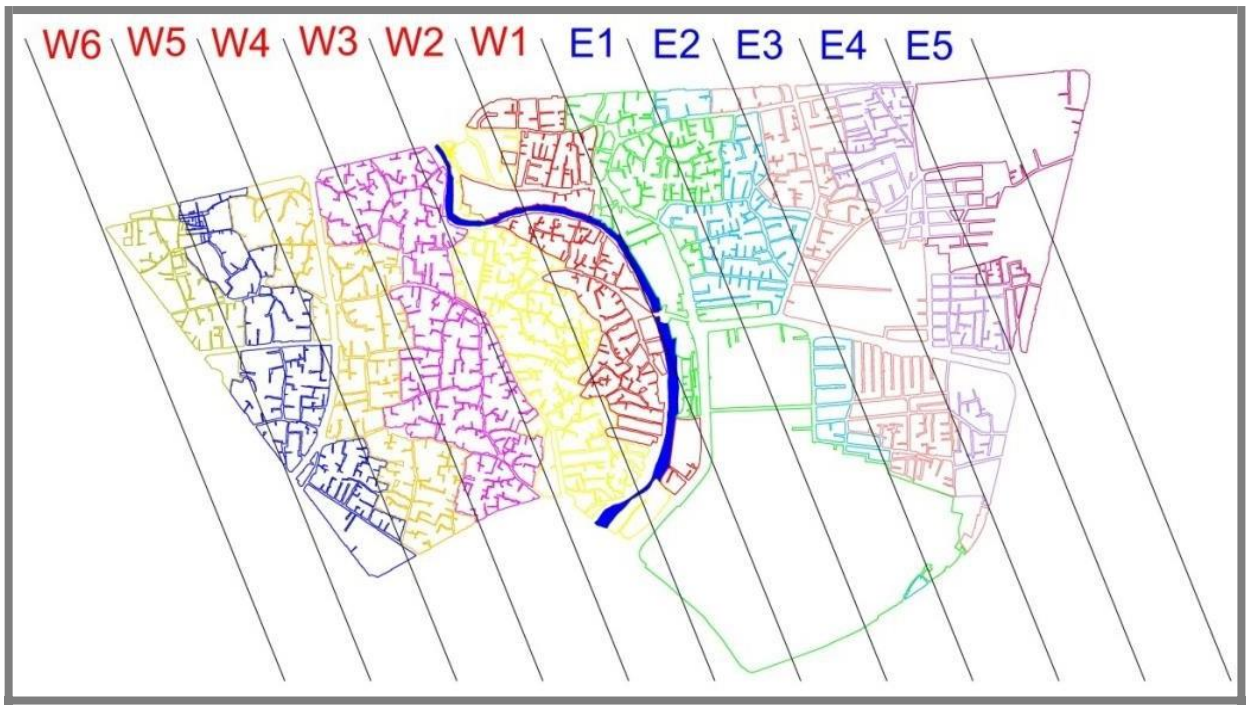

Fig.2. Division of the river into western and eastern parts (Source: the author)

Then, by defining two dimensions of the paths and block based on typology and measurement, we analyzed the form as a component in urban morphology, and finally the results are presented.

Case Study

Rasht as the largest city in the southern margin of the Caspian Sea and as one of the largest cities in Iran with a population range of 500,000 to 1 million people is the political-administrative capital of Guilan province (Musa Kazemi, 2012: 87). Rasht is located in the center of Gilan plain, in eastern longitude of 49 degrees, 35 minutes and 45 seconds, and northern latitude of 37 degrees, 16 minutes and 30 seconds. It has an area of about 10240 hectares.

Rasht has a temperate Caspian climate which is characterized by significant rainfall, high humidity, hot weather and slight variation in temperature. This climate is similar to temperate climate in Köppen and Geiger systems (Yaran, 2013: 8).

The city's formation process initially started from the original nucleus, between the rivers of Goharood and Zarjoob, with a slight tendency toward the East, which has spread between the two rivers. This expansion continued during the Safavid and Qajar dynasties, without noticeably altering the physical structure of the new neighborhoods. At the beginning of the Pahlavi dynasty, the city occupied almost the entire distance between the two rivers before the start of the Reza Shahi streets (Fig. 3.) (Design and Exploration Engineering, 2007, 1-2).

Rasht has five fabric zones: old, regular, rural-urban, unauthorized and heterogeneous. Thus, according to the above description, the zones that we should investigate are the first three zones (old fabric), the second (regular fabric) and fifth zones (Fig 4).

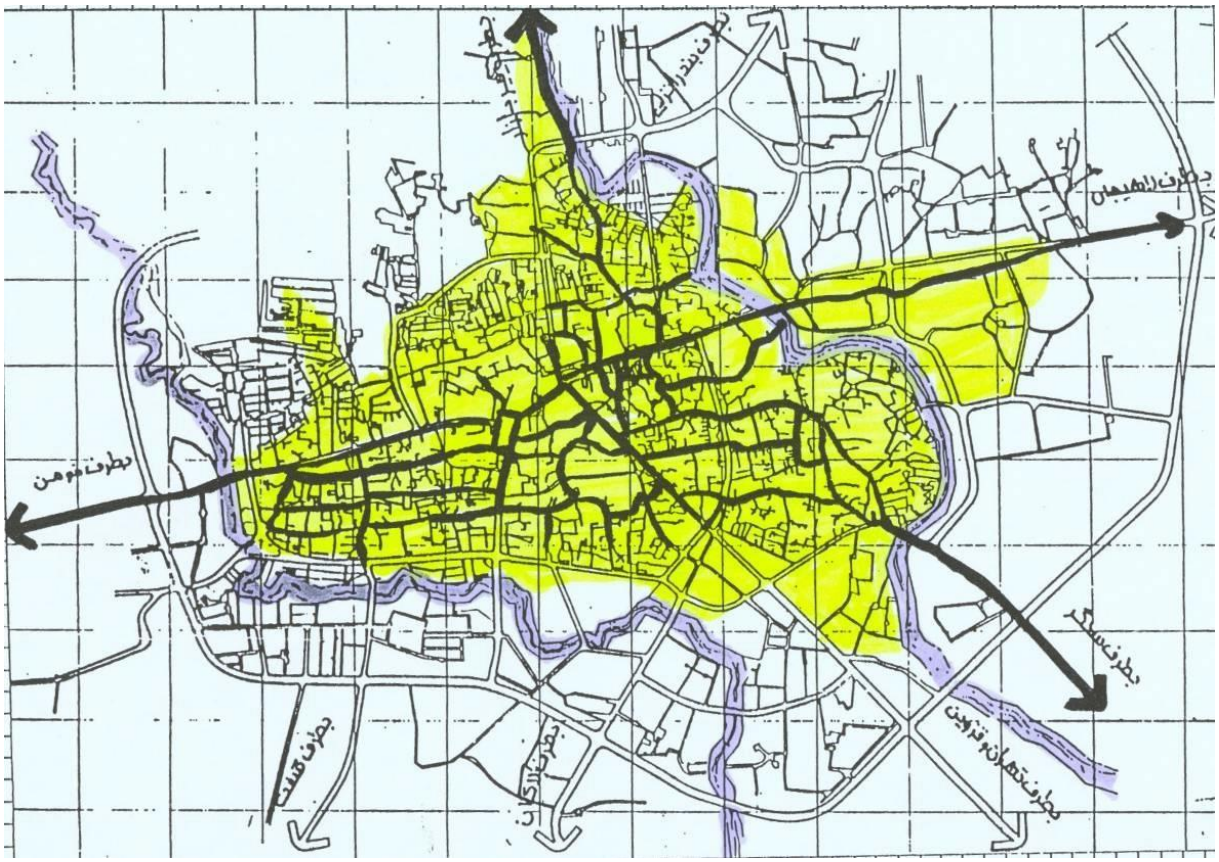

Fig. 3. Rasht in the first year of developing the first Comprehensive Plan (1966) - The red circle is the study area (Source: Design and Exploration Engineering)

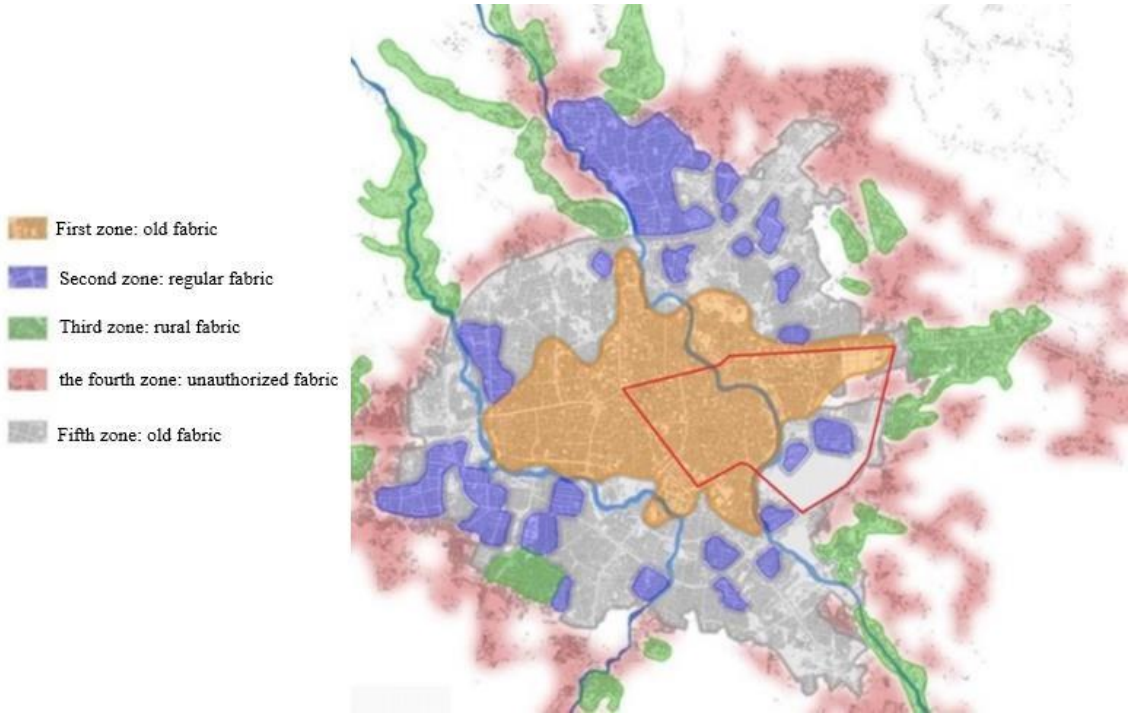

Figure 4. Zoning of Rasht (Source: Design and Exploration Engineering)

The total area is about 4577364 square meters (457.7364 ha) (Fig. 5).

Figure 5. Study area (Source: Google Earth)

Form in urban morphology

Gideon Golany (1995: 148) argues that given the weather conditions, urban planning deals with the general morphology of a city. In order to explain how to study cities in terms of morphology, Golany has introduced some parameters that includes street width, forms, configuration and orientation, building heights, urban density or sprawl, urban open spaces, integration or separation of land use and other physical considerations, which should be taken into account. Closer examination of this point requires clear recognition and classification, as in this study the emphasis is on form, the study has focused on morphological analysis of paths and blocks so that the results could be available in a framework. Therefore, in order to study the form in urban morphology, at first we present a short description of urban paths and blocks, and then we examine two aspects of the morphology of paths and blocks:

Urban paths

Paths in urban spaces include streets, alleys, etc., that urban sociologists believe life and civilization in a city found its meaning with relation to its open spaces, as Jane Jacobs (1961) argues "Thinking about a city means to depict its streets." In addition, those who are concerned with environmental perception consider roads as the most important factor in the organization of mental mapping of man (Mohammadi, 2012: 86).

Urban blocks

In order to homogeneously define the spaces, it is necessary to enclose the adjacent plots that are interconnected or closely spaced with buildings and have three variables of block size, the ratio of spaces, and corner rotations (Towers, 2005: 105).

Morphology of paths

In morphological construct of cities, natural and human elements have a significant role among human factors; however, the network of streets and allies and communication networks in total are one of the most important factors in the morphological construct of a city. Streets outline a city's integrated morphological networks. Nevertheless, the topographic factors of the earth in a city, such as plains, slopes, and river flows, are in some ways effective in developing the streets

and the quality of their networking and ultimately in constructing the shape and form of the city (Shah Ali, 2010: 129).

Therefore, paths are known as one of the most important morphological elements of the blocks and urban forms. In this research, after the analysis, paths are divided into seven indices, which are shown in Table 1.

Table 1

Items of paths (Arsiya, 2013: 50-51)

	Dimensions	Indices	Items
Forms	Morphology of paths	Number of paths in each block	Without paths
			1-3
			4-6
			7 - 9
			More than 9
		Average length	Less than 20 meters
			20 - 50 meters
			50 - 100 meters
			More than 100 meters
		Average width	Less than 3 meters
			3 - 6 meters
			6 - 9 meters
			More than 9 meters
		Permeability	Permeable
			Impermeable
		Orientation	North-South
			East-West
		Slope of paths	Less than 2 %
			2 to 5 %
			More than 5 %
		Distribution of paths	Linear
			Tree
			Network

Morphology of blocks

Sultanzadeh (2011: 72), in an article titled "The role of geography in the formation of different types of courtyards in traditional Iranian houses" argues that the effects of the natural environment on the form of architectural spaces is not limited to building materials, rather the effects of the natural environment generally include various phenomena, such as climate, altitude, distance from the sea or river, geological structure, etc., each of which has been specifically involved in the spatial composition of the buildings.

Azizi (2011: 7) in the article "Urban sprawl based on Building Density Index" states that formal and structural changes of a city occur when blocks and interdependent dense urban areas, simultaneous with the urban growth, make changes concurrent with different parts of the city.

Behzadfar (2012: 844), in the article "Morphological analysis of Firoozkooh" argues that the street patterns make it possible to locate the urban blocks, and among them, the development of public spaces, motorways or public space networks. Either blocks define spaces, or spaces define the blocks.

Therefore, blocks can be considered as the main element of the form in the urban morphology. In this research, blocks are divided into fourteen indices listed in Table 2.

Table 2

Items of the blocks (Arsiya, 2013: 51-53)

	Dimensions	Indices	Items
Forms	Morphology of blocks	Occupy coefficients	0-0.25
			0.26-0.50
			0.51-0.75
			0.76-1
		Building density	0-0.50
			0.51-0.75
			1.01 - 1.5
			1.51-2
			More than 2
		Number of building sites in a block	1 - 25
			26 - 50
			51 - 75
			76 - 100
			More than 100
		The average number of floors of buildings on a block	1 - 1.5 floors
			2 - 2.5 floors
			3 floors
			more than 4 floors
		Block area	Less than 5,000 square meters
			5000 - 10,000 square meters
			10,000 - 15,000 square meters
			15,000 - 20,000 square meters
			More than 20,000 square meters
		Block distance from the river	Less than 50 meters
			50 - 200 meters
			200 - 500 meters
			500 - 1000 meters
			More than 1000 meters
		The overall form of building sites on a block	Regular rectangular
			Irregular rectangular
			Polygon
		Placement of adjacent building sites on a block	Continuous linear
			Continuous central
			Scattered
		Overall direction of building sites on a block	North - South
			East - West
			none-directional
		The overall form of yards	Yard in One Side
			Yard in Two Sides
			Yard in the Middle
		Size	Small
			Medium
			Large

		Distribution of different sizes	Homogenous
			Heterogeneous
		Block orientation	North - South
			East - West
		The overall form of the blocks	Triangular
			Quadrangular
			Polygonal

Zarjoob is the river examined in this study (Fig. 6), and the selected area, according to Fig.4, includes the first three zones (old), the second (regular) and the fifth zones.

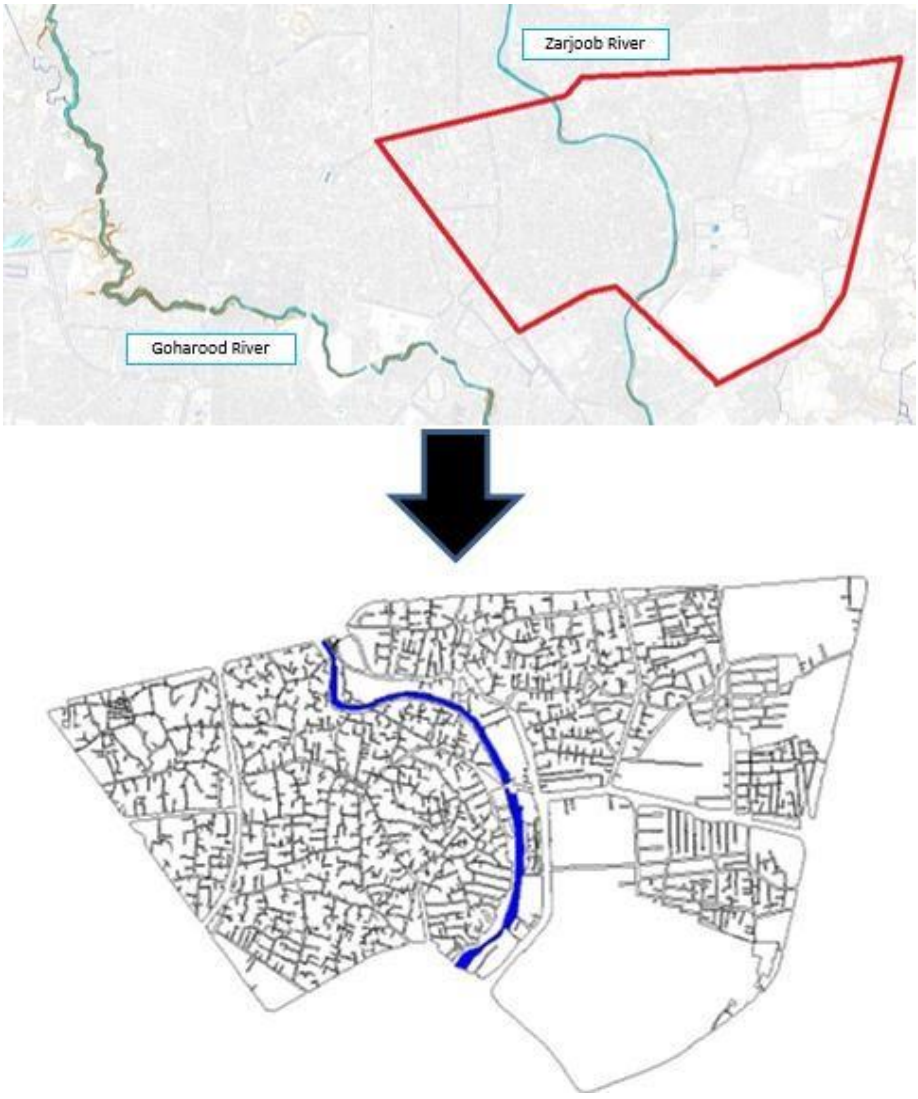

Figure 6. Zarjoob River and the study area (Source: the author)

Using a line parallel to the main axis of the river, we have divided the study area into six columns in the west and five columns in the east. For better overlap between the blocks in the columns, the distance between these lines was taken 300 meters.

Those blocks that are in the eastern columns are marked with the letter E, and the blocks in the western columns are marked with the letter W. For example, E3 represents the 3rd eastern column located in 600 to 900 meters from the river.

Then we have given a number to blocks in each column, as shown in the above figure, column W1 has 27 blocks (Fig. 7). Column W2 has 28 blocks (Fig. 8). Column W3 has 16 blocks (Fig. 9). Column W4 has 22 blocks (Fig. 10).

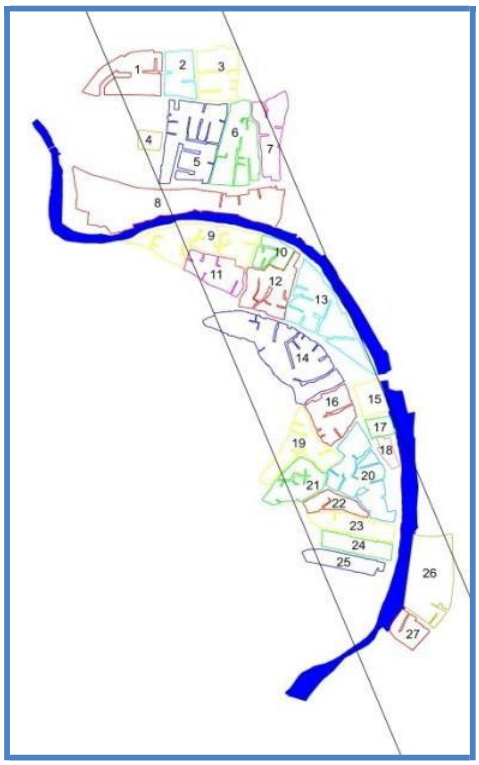

Figure 7. Column W1 (source: the author)

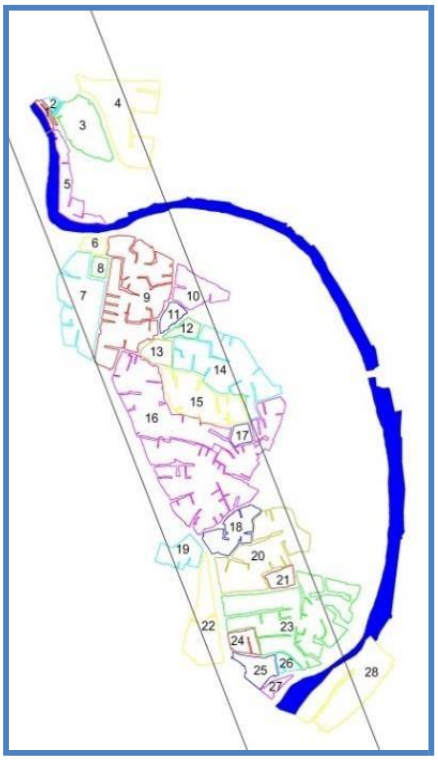

Figure 8. Column W2 (source: the author)

Figure 9. Column W3 (source: the author)

Figure 10. Column W4 (source: the author)

Column W5 has 28 blocks (Fig. 11). Column W6 has 14 blocks (Fig. 12). Column E1 has 17 blocks (Fig. 13). Column E2 has 18 blocks (Fig. 14).

Column E3 has 30 blocks (Fig. 15). Column E4 has 34 blocks (Fig. 16). Column E5 has 13 blocks (Fig 17).

Figure 11. Column W5 (source: the author)

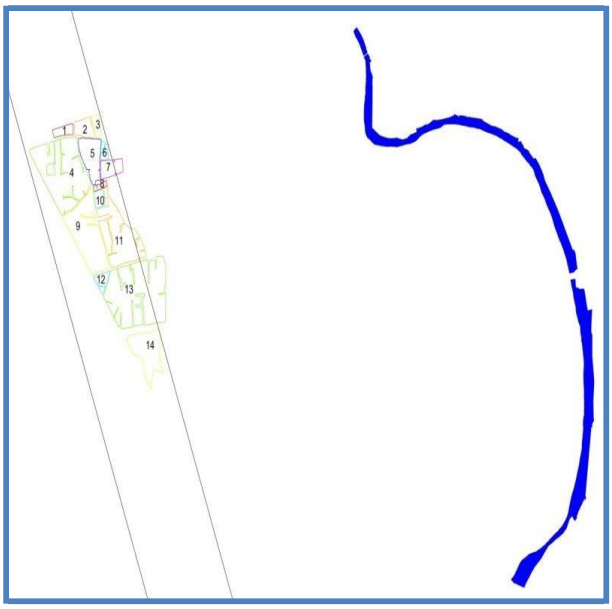

Figure 12. Column W6 (source: the author)

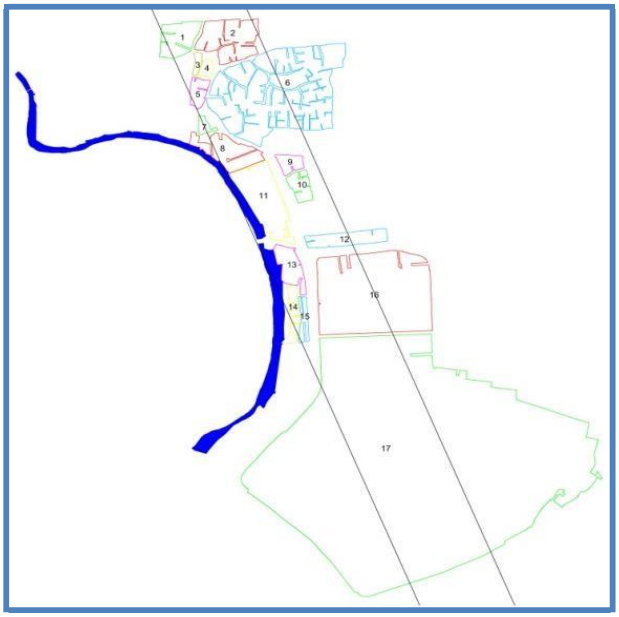

Figure 13. Column E1 (source: the author)

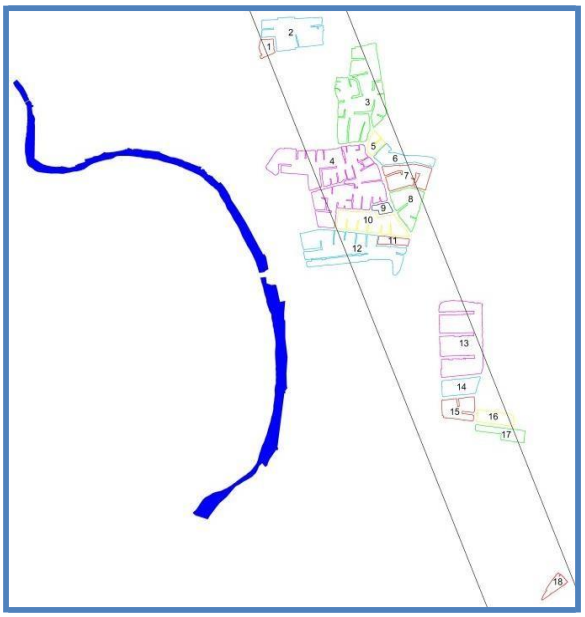

Figure 14. Column E2 (source: the author)

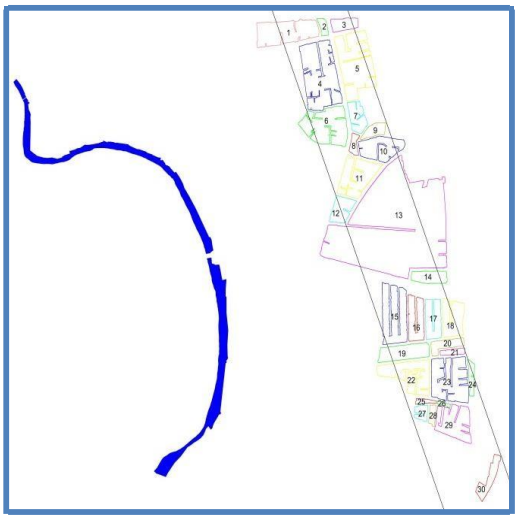

Figure 15. Column E3
(source: the author)

Figure 16. Column E4
(source: the author)

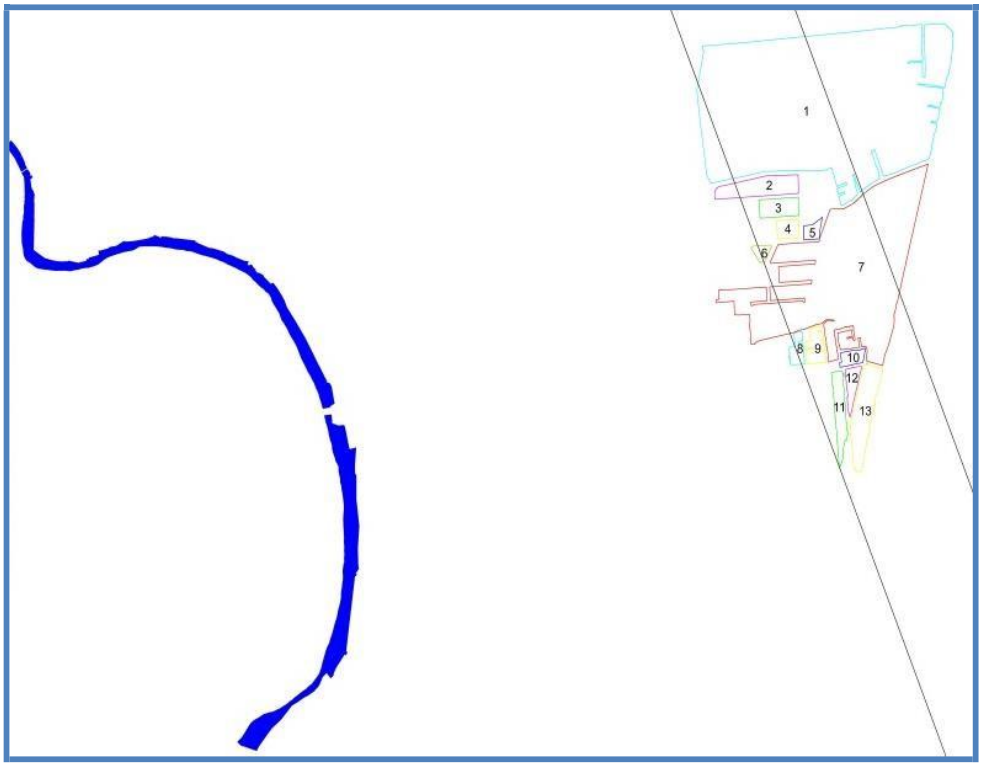

Figure 17. Column E5 (source: the author)

After extracting the data of each column according to Tables 1 and 2, the highest frequency of the indices were extracted and shown in Tables 3 and 4.

Table 3

Approaches to paths

Dimensions	Indices	The highest frequency
Paths	Number of paths in each block	1 - 3
	Average length	20 - 50 meters
	Average width	3 - 6 meters
	Permeability	Impermeable
	orientation	North-South
	Slope of paths	Less than 2 %
	distribution method	Linear

Table 4

Approaches to paths

Dimensions	Indices	The highest frequency
Morphology of blocks	Occupy coefficients	0.51 - 0.75
	Building density	0.51-1
	Number of building sites in a block	1 - 25
	The average number of floors of buildings on a block	1 - 1.5 floors
	Block area	Less than 5,000 square meters
	Block distance from the river	500 - 1000 meters
	The overall form of building sites on a block	Regular rectangular
	Placement of adjacent building sites on a block	Continuous central
	Overall direction of building sites on a block	North-South
	The overall form of yards	Yard in One Side
	Size	Small
	Distribution of different sizes	Heterogeneous
	Block orientation	North-South
	The overall form of the blocks	Quadrangular

Conclusion

Urban morphology in different climates and regions give a rise to various urban forms, in a way that each climate has its own typological factors and indices based on urban forms. The purpose of the present study was to investigate these indices and find a significant relationship between them. Having conducted the studies, the main approaches in blocks and paths were outlined. Therefore, the following relationship between some indices has been discovered:

- Blocks with an area of less than 5000 square meters, are devoid of paths and the orientation of their blocks is East-West.
- The orientation of paths in blocks that are linearly distributed is North-South.
- The majority of blocks that have a quadrangular form are located 500 to 1000 meters away from the river.
- Blocks whose paths are between 20 to 50 meters long are polygonal.
- The building site of blocks 3 to 6 meters wide, are irregular rectangular and they have a none- directional orientation.
- Blocks with regular rectangular building sites, have a homogeneous distribution and East-West orientation.
- Blocks that have a linear distribution are small size.
- Impenetrable blocks have a North-South orientation.

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